Pond Reservoir Systems Application in Tiger Shrimp (*Penaeus monodon* fab.) Cultivation in West Java, Indonesia

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ABSTRACT

Numerous issues have arisen as a result of the pond culture industry's rapid development and the rising incidence of seawater contamination from home, agricultural, industrial, and mining wastes as well as waste from the ponds themselves. As a result, the shrimp fry, which were still little and had a low level of acclimation, were susceptible to disease. As a result, we require a technology that can assist in overcoming the subpar water used in shrimp ponds. Pond reservoir system application is one of these systems. The reservoir utilized merely serves as a container for settling, filtering, and biological treatment, without any preceding chemical treatment, to enable the deployment of this system by pond farmers. A reservoir can be used to store water sources before they are used to fill ponds as part of efforts to preserve water quality that is suitable for shrimp. To conserve water and stop disease transmission from water sources, a recirculation system is used in the appropriate reservoir area, which is 30–40% of the total area of aquaculture ponds.

Keyword: *aquaculture, pond, reservoir, shrimp, treatment*

1. INTRODUCTION

Tiger prawn cultivation is one of the fisheries activities that is relied upon in meeting fisheries production targets in Indonesia. This shrimp farming activity is intended for local consumption as well as an export commodity. The West Java region, especially the north coast, is the basis for the development of shrimp farming. This is because this coastal area has a fairly large area of aquaculture [1]. The rapid rate of development of pond cultivation along with the increasing occurrence of seawater pollution by domestic, agricultural, industrial and mining wastes as well as waste from the ponds themselves has caused many problems to arise. One of the prominent problems is the high mortality rate of shrimp at the stocking stage in ponds. The results showed that one of the causes of death was the poor quality of the supply water flowing into the pond area. This resulted in the shrimp fry being susceptible to disease which were still relatively small (PL 12-15) and their acclimatization level was low. Therefore, we need a system that can help overcome the poor quality of water used in shrimp ponds. One of these systems is the pond reservoir system application.

2. ROLE AND FUNCTION OF POND RESERVOIR IN SHRIMP CULTIVATION

One way to improve the quality of water supplied to ponds is to implement a reservoir system. Reservoir plots are an important part of a pond with intensive technology, where in this case the reservoir functions as a temporary storage container for seawater before it is then distributed to each cultivation plot [2].

This pond reservoir system is one of the government programs (Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia) with the aim of increasing pond productivity in Indonesia, which is also known as the Shrimp Culture Health Management (SCHM) Program. In detail, the function of the reservoir is as: (1) a water reserve container; (2) a container for settling and filtering water (physical treatment) before entering the ponds; (3) containers for chemical and biological treatment.

To facilitate the application of this system by pond farmers, the reservoir used only functions as a container for settling, filtering and biological treatment, without prior chemical treatment. Sedimentation and filtering stages are intended to reduce water turbidity, stabilize pH, dissolved oxygen (DO), salinity and ammonia levels. Besides that, it can also function as a filter for carriers of disease. While during the biological treatment stage, various types of shellfish, milkfish or *Gracillaria* spp. seaweed will be put into the reservoir. This biological treatment is intended to carry out initial screening in ponds by living things for water-borne pathogens before entering the pond plots. It is hoped that the water that enters the pond plots is of prime quality and free from pathogens, so that in turn it can increase pond productivity.

The activities applied in pond reservoir system cultivation are as follows:

1) Equipment and Materials
    a. The reservoir plot used is a 20 m X 5 m plot, then the reservoir is further divided into two plots consists of physical treatment plot and a biological treatment plot
    b. Biological treatment plots, using various types of shellfish, milkfish, and seaweed *Gracillaria* spp. as a treatment
    c. The growth plot has a size of 0.5 ha.
    d. The tiger prawn seeds used are the size of shrimp fry (2-5 cm).
    e. Commercial feed
    f.Equipment for measuring water quality: thermometer, pH meter, DO meter, ammonia test kit
    g. Sampling tools, including lift nets, nets and shovels.
2) Procedure
    a. Before stocking, land preparations are carried out which consist of controlling pests, diseases and predators using the Brestan pesticide. Then liming was carried out at a dose of 1 ton/ha and fertilization using SP 36 fertilizer at a dose of 100 kg/ha and manure fertilizer as much as 1 ton/ha.
    b. The stocking density of shrimp is 20,000 heads/ha,
    c. The feed given during shrimp rearing is in the form of commercial feed containing 3 - 5% protein with a frequency of feeding 3 times a day.
    d. During the rearing phase, monitoring and evaluation of water quality is carried out in the reservoir plots and growth pond plots of the reservoir system and community-owned ponds (non-reservoir system) as a comparison. The quality parameters measured were water temperature, pH, DO, salinity and ammonia levels.
    e. Harvesting is done after 90 days of rearing.

3. POND RESERVOIR SYSTEM EVALUATION OF TIGER SHRIMP PRODUCTION

Tiger prawns are organisms that are benthic or live at the bottom of ponds, thus the water and mud conditions at the bottom must be managed properly to maintain a proper environmental quality for the life and growth of shrimp [3]. According to [4] the determining components of the feasibility of ponds as tiger shrimp habitat are water and sediment quality. Table 1 shows some recommended water quality parameters for tiger prawn ponds, meanwhile, the pond water quality requirements are presented in Table 2.

Table 1. Recommended Water Quality Parameters for Tiger Shrimp Ponds

Water Quality Parameters	Optimum Level	Description
Water temperature	26-30^{o}C	Daily fluctuation <3
pH	7.7-8.5	Daily fluctuation <0.5
Salinity	10-25	Daily fluctuation <5
Water depth	80-120	Depends on technology
Water brightness	30-40	Plankton density indicator
DO	5-6	Preferably no less than 4
Alkalinity	> 80	Water pH stabilizer

H_2S	< 0.03	Dangerous in acidic conditions
NH_3	< 0.01	Dangerous at high pH and temperature
C : N : P ratio	106 : 16 : 1	Fertilizer dosage determinant

Source: [5]

Table 2. Pond Water Quality Requirements for Stocking

Water Quality Parameters	**Optimum Level**
Water temperature	28-32^{o}C
pH	7.8-8.5
Water depth	>70cm
Water brightness	35-45 cm (green/light brown)
DO	>3 ppm
Alkalinity	90-140 ppm
Total Organic Matter (TOM)	<150 ppm

Source: [6]

Table 3. Optimal Parameters for Pond Bottom Soil Quality

Parameters	**Optimal Range**	**Description**
Organic matter (%)	6.0-8.0	All soil quality parameters should be in the optimal range
Redox potential (mV)	<9.0	
NH_3 (ppm)	< -220	
Phosphate (ppm)	0.03 – 0.05	
Texture (fraction)	0.05 – 0.10	
	Clay (60-70% and sand (30-40%)	

Source: [7]

Efforts to maintain water quality to suit the needs of shrimp can be done in several ways, including by using reservoirs as reservoirs for water sources before water is flowed into ponds. Recirculation and reservoir technologies were introduced and developed in 1993 for pond farmers in Indonesia. Improving the quality of water in reservoirs includes the process of settling, filtration, and biological and/or chemical treatment. The recommended reservoir area is 30-40% of the total area of aquaculture ponds, and uses a recirculation system so as to save water and prevent disease transmission from water sources.

Figure 1. Pond layout equipped with a reservoir[1]

[1] https://efishery.com/fungsi-tandon-di-tambak-udang/

Biological water treatment can be done by utilizing aquatic organisms. [5] stated that the use of milkfish, shellfish, and Gracilaria sp seaweed as biofilters can improve the quality of water to be used in tiger shrimp ponds. Some shellfish, oysters and seaweed are known to be able to absorb bacteria from the waters (Table 4) and are effective in absorbing heavy metals which are toxic to shrimp. Meanwhile, milkfish is used as a bioscreening agent for diseases that will attack shrimp.

Table 4. The ability of shellfish to absorb bacteria

Types of Filter Biota	Bacterial Density		
	Shrimp Plot	Biofilter Plot	Pond Reservoir Plot
Green mussel (*Perna viridis*)	128.2	36.1	11.3
Mud oyster (*Crassostrea iredalei*)	104.4	37.2	9.0
Mangrove Clams (*Geloina coaxan*)	113.1	50.0	9.6

Mangrove oyster (*Crassostrea iredalei*) which has a shell size of 5-7 cm with a density of 0.75 kg/m^2 is able to accumulate Pb and Cu respectively 1.185% and 473% of their initial content. Researches references in [5] showed that mangrove clams (*Geloina coaxan*) which have a shell width of 4-5 cm with a density of 6 individuals/m^2 have a high absorption capacity for phytoplankton (98%), heavy metal Ni (89%), Cr (28%), Zinc (43%) and bacteria (69%) from the initial concentration. Besides that, mangrove shells were able to reduce the total organic matter content in pond water from 12.5 ppm to 2.25 ppm for 3 months of rearing. *Gracilaria* sp. seaweed. capable of absorbing heavy metals Pb and Cu respectively 1.187 and 1.867% of the initial concentration.

Several studies have also shown that the use of reservoirs can increase the production of tiger prawns. [5] stated that shrimp production in ponds equipped with reservoirs (103.15 kg/250 m^2) was much higher than production in ponds without reservoirs (50.5 kg/250 m^2). Meanwhile a study reported that the use of reservoirs was able to increase tiger prawn production up to 147 kg/500 m^2. The reservoir system also indirectly provides an opportunity to increase profits from the production of biofilter organisms contained in the reservoir.

4. CONCLUSIONS

In order to maintain a suitable habitat for the survival and growth of shrimp, the water and sediment conditions at the bottom of ponds where tiger prawns are found must be appropriately controlled. Water and sediment quality are the key factors in deciding whether ponds are a viable home for tiger shrimp. Installing a reservoir system is one technique to improve the quality of water provided to ponds. An essential component of a pond with intensive technology is a reservoir plot, which in this case serves as a temporary container for storing seawater before it is distributed to each agricultural plot. The reservoir serves as a water reserve, a physical treatment container for stabilizing and filtering water before it enters the ponds, and a container for both chemical and biological treatment.

5. REFERENCES

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